Space Weather Forecast

Issued on Tuesday, 20 December 2022 at 01:15 Local

This forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of Moderate-class X-ray flares and Minor Geomagnetic Storms.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low over the past 24 hours, with occasional mid-high level Common-flares observed. The most active region is a moderately large and complex region in the far northeast. There are six other sunspot regions on the visible disc. The largest of these is in the southwest though has shown some signs of decay during the period. A new region has rotated over the northeastern limb, though remains fairly small and simple at this time.

There remain numerous filaments on the earth-facing disc, one of which erupted from the centre northern disc around 19/2130 UTC. This was a relatively small filament, but will be analyzed for any potential Coronal Mass Ejections (CMEs) as and when sufficient imagery becomes available. Additionally, a number of high-speed jets of plasma have emanated from the largest region in the northeast. It is possible one of these has resulted in the lift-off of another small filament located just to the south of the group, though again, will require more imagery to confirm this. There were numerous CMEs observed in coronagraph imagery in the period, though none appear Earth-directed with the largest associated with a Common-flare from the largest group in the northwest after 19/1100 UTC and passing well ahead of Earth orbit.

Solar Wind / Geomagnetic Activity: Solar winds have remained slow through the period varying between 300-360km/s. The total magnetic field strength was predominantly moderate, but briefly peaked at strong at 19/0124 UTC. The important north-south direction of the magnetic field was mainly southward (negative). The solar wind profile suggests the arrival of fast wind stream, albeit very slow. There may also have been some minor CME effects encompassed within. Resultant geomagnetic activity was mainly Quiet to Unsettled (Kp 1-3), but with an Active (Kp 4) interval 19/0300-0600 UTC.

Energetic Particles / Solar Radiation: No solar radiation storms were observed in the period.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is currently Low. There is a chance of this increasing to Moderate at times due to isolated Moderate-class flares, and a slight chance of a Strong flare. There are currently seven sunspot regions on the disc, with a couple of moderately large, complex regions; one in the northeast, the other in the southwest. Successive departures over the western solar horizon through the period may be compensated for by potentially large arriving regions in the east, although this aspect of the forecast carries low confidence, and for now the risk is held constant throughout.

Solar Wind / Geomagnetic Activity: A CME from 18th December may produce a glancing blow at Earth on Day 2/3 (21st/22nd), but carries low confidence. Two potential candidate CMEs are awaiting further coronagraph imagery to determine if they could be earth-directed. The period, otherwise, will be characterized by the effects of two high-speed streams. One affecting earth

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from the start of Day 1(20th) and another stronger coronal hole arriving on Day 1 or Day 2 (21st), likely bringing Elevated or Strong solar winds. Geomagnetic activity is forecast (but with lower than average confidence) to be mainly Quiet initially, but increasing to Unsettled to Active late on Day 1 (20th), with a chance of G1/Minor Storm conditions. This continues into Day 2, but the risk should gradually reduce with time, allowing more prolonged periods of Unsettled, then Quiet activity by Day 3 (22nd) onwards, in the absence of any potential CME effects.

Energetic Particles / Solar Radiation: No solar radiation storms are expected, although there is slight chance with the occurrence of any notable flares.

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Geomagnetic Storms:

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	40	40	20	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X Ray Flares:

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	40	40	40	30
Very Active	R3 to R5 X	No	5	5	5	5

Solar Radiation Storms - (High Energy Protons):

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	10	10	10	10
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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